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Developmental reversals in false memory: Effects of emotional valence and arousal

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ABSTRACT

Do the emotional valence and arousal of events distort children's memories? Do valence and arousal modulate counterintuitive age increases in false memory? We investigated those questions in children, adolescents, and adults using the Cornell/Cortland Emotion Lists, a word list pool that induces false memories and in which valence and arousal can be manipulated factorially. False memories increased with age for unpresented semantic associates of word lists, and net accuracy (the ratio of true memory to total memory) decreased with age. These surprising developmental trends were more pronounced for negatively valenced materials than for positively valenced materials, they were more pronounced for high-arousal materials than for low-arousal materials, and developmental increases in the effects of arousal were small in comparison with developmental increases in the effects of valence. These findings have ramifications for legal applications of false memory research; materials that share the emotional hallmark of crimes (events that are negatively valenced and arousing) produced the largest age increases in false memory and the largest age declines in net accuracy.

Introduction

Developmental reversals in false memory are surprising age increases in children's tendency to remember things that did not happen to them. Such increases are remarkable because it has been

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thought for more than a century that false memory declines sharply between early childhood and young adulthood (e.g., Binet, 1900; Small, 1896; Stern, 1910; Whipple, 1909). There is a large literature of recent vintage that supports this long-standing belief (for reviews, see Bruck & Ceci, 1999; Ceci & Bruck, 1995, 1993; Goodman, 2006; Goodman & Schaaf, 1997; Poole & Lamb, 1998; Quas, Qin, Schaaf, & Goodman, 1997; Reyna, Mills, Estrada, & Brainerd, 2007). For instance, age declines in false memory have been reported in many studies of memory suggestion, a paradigm that is designed to parallel the coercive forensic interviewing techniques that first focused scientific attention on children's false memories (e.g., Bjorklund, Bjorklund, & Brown, 1998; Bjorklund et al., 2000; Eisen, Qin, Goodman, & Davis, 2002; Goodman, Quas, Batterman-Faunce, Riddlesberger, & Kuhn, 1994; Holliday & Hayes, 2000; Holliday & Hayes, 2001; Marche, 1999; Marche & Howe, 1995). Likewise, age declines have been detected with false memory paradigms that do not provide children with memory suggestions. Examples include free and cued recall of live events (e.g., Pipe, Gee, Wilson, & Egerton, 1999; Poole & White, 1991), free and cued recall of word lists (e.g., Bjorklund & Muir, 1988), memory for mathematical propositions (Brainerd & Reyna, 1995), memory for narratives (e.g., Ackerman, 1992; Ackerman, 1994), sentence recognition (e.g., Reyna & Kiernan, 1994; Reyna & Kiernan, 1995), and word recognition (e.g., Brainerd, Reyna, & Kneer, 1995).

However, Brainerd, Reyna, and Ceci (2008a) recently concluded that despite extensive documentation of age declines in false memory, there is mounting evidence of reversals of that pattern under conditions that are both theoretically and pragmatically important. Brainerd and colleagues reviewed more than 30 experiments in which such reversals were identified. In some, age increases in false memory were more pronounced than corresponding increases in true memory, so that the net accuracy of memory (the ratio of true memory to total memory) actually declined between childhood and adulthood (e.g., Metzger et al., 2008). Brainerd and colleagues noted that although such findings are surprising, the developmental reversal effect is not a serendipitous discovery because it was predicted on theoretical grounds some years before relevant studies were conducted. Specifically, the effect was predicted by fuzzy trace theory (FTT) (see Brainerd & Reyna, 1998; Ceci & Bruck, 1998), which posits that age increases in false memory are apt to occur in situations that have two features, namely that (a) false memories arise from people's propensity to connect meaning across distinct events that share meaning and (b) it is difficult to use verbatim traces of actual events to suppress those distortions.

In the developmental studies that Brainerd and colleagues (2008a) reviewed, Deese/Roediger/McDermott (DRM) lists (Deese, 1959; Roediger & McDermott, 1995) were the most frequently used example of a task that exhibits both of these properties. With respect to the first property, a DRM list consists of a series of familiar words that share meaning with each other (e.g., *nurse*, *sick*, *ill*, *hospital*, *medicine*) and for which there is a missing word that is a semantic associate of all the list words (*doctor* in this instance). When adults are exposed to such lists and respond to immediate recognition or recall tests, missing words (usually called critical distractors or critical lures) are falsely recognized more than 70% of the time and falsely recalled more than 20% of the time on average. Concerning the second property, after being exposed to such a list, it is difficult to suppress false memories of unpresented words such as *doctor* by recalling presented words such as *ill*, *hospital*, and *nurse* because participants are well aware that there are many other presented medical words that they cannot recall and *doctor* could easily be one of them (Brainerd, Reyna, Wright, & Mojardin, 2003).

Several experiments have confirmed FTT's prediction that false memories of DRM critical distractors should increase during child-to-adult development. In the initial confirmation, Brainerd, Reyna, and Forrest (2002) found that both false recall and false recognition of critical distractors increased between early childhood and young adulthood, with floor levels of false recall being observed under 7 years of age. In their literature review, Brainerd and colleagues (2008a) surveyed 26 published experiments in which DRM lists had been administered to participants ranging in age from young children to young adults, 25 of which detected reliable age increases in false memory. Brainerd and colleagues also found that the accumulated literature showed that the formation of meaning connections between list words is both necessary and sufficient to produce age increases in DRM false memory. Regarding necessity, manipulations that interfere with older participants' greater ability to form meaning connections have been found to reduce or eliminate age increases (e.g., Connolly & Price, 2006; Holliday & Weekes, 2006). Regarding sufficiency, manipulations that enhance younger participants' lesser ability to form such connections have likewise been shown to reduce or eliminate age